New York Western Bean Cutworm Monitoring Program
Progress Report (2010-2015)

J. Keith Waldron
NYS Integrated Pest Management Program
Cornell University, NYS Agricultural Experiment Station
April 19, 2016

The Pest Problem

Western bean cutworm (*Striacosta albicosta* [Smith]) attacks corn (*Zea mays* L.; including field, sweet and popcorn) and dry beans (*Phaseolus vulgaris* L.), feeding on developing kernels or beans inside husks and pods, respectively. Western bean cutworm (WBC) infestations can cause significant yield losses and may facilitate subsequent colonization by pathogens, furthering damage and impacts. WBC moth, egg mass and larva images are shown below (Fig 1, 2 and 3).


Figure 1. WBC Moth


Figure 2. WBC egg mass


Figure 3. WBC Larva in corn ear

Western bean cutworm (WBC) is native to North America, but has historically been restricted to the Great Plains and westward. Over the past decade, WBC has expanded its range through the Midwest into the northeastern United States and Canada. As WBC has moved eastward, its caterpillars have caused economic damage, particularly in Michigan and Ontario, where growers have reported 8-10% losses in dry beans and 40% losses in field corn. WBC moths were first discovered in Pennsylvania and New York in 2009 and Vermont in 2011. Pheromone trapping was initiated in NY and PA in 2010 and in VT in 2011 in collaboration with scientists from Penn State University and University of Vermont to gain knowledge about WBC populations and better assess their potential risk to corn and dry bean acres in the Northeast. The trapping network has revealed western bean cutworms are becoming more widely distributed and populations are increasing, posing a potential risk to dry beans and the over 3.5 million acres of corn grown in NY, PA, and VT. To date, only non-economic larval infestations have been found in Pennsylvania and Vermont. However, in 2015 some WBC damage was reported to untreated fresh market sweet corn in northern NY (11% losses in Oswego, NY, M. Zuefle pers. com.), WNY field corn (M. Stanyard, WNY CCE Dairy/field crop team, pers. com). 2015 was also the first year WBC feeding damage was seen in the field on dry bean pods. Some dry bean producers have begun to apply an insecticide just after the time of peak moth emergence (C. MacNeil, WNY CCE Veg Program).

Monitoring Procedure:

WBC male moths are trapped using a green "universal" bucket trap hung on posts at the edge of corn or dry bean field sites (Fig. 4). Traps contain the WBC pheromone lure that mimics a female scent to attract male moths. In addition, an insecticide strip is placed in the trap to kill the moths once inside. WBC trapping was initiated the second week of June and continued until early September. Traps were checked weekly and number of moths collected recorded. Moth

capture data was entered in PestWatch (www.pestwatch.psu.edu) and shared with the local and regional agricultural community through timely newsletters.

Figure 4. Bucket trap used to collect WBC moths

2010-2015 Results

A volunteer-based WBC pheromone trap monitoring network has been in place in NY since 2010. This 2015 program report summarizes WBC collection data from several sources including Cornell Cooperative Extension coordinated field corn, sweet corn and dry bean pheromone monitoring networks and data provided by private agricultural consultants and agribusinesses. NY WBC populations have increased annually since 2010 as indicated by the average and maximum range in number of WBC moths captured per location (Table 1). A total of 20,844 WBC moths were collected in 2015, compared to 11,353 collected in 2014, and more than 3 times the 6,110 WBC moths collected in 2013. Location and relative moth counts for 2015 trap sites are shown in Figure 5. On average, higher WBC counts have been observed in northern and western counties with the majority of high captures occurring in locations north of the NYS thruway (Interstate 90). Moth wings are covered with fine scales that can rub off over time with use. The relatively undamaged wing condition of many of the WBC moths captured indicate WBC populations are emerging locally and becoming locally established.

Table 1. New York Western Bean Cutworm 2010 – 2014 Collection Data Summary*

	2010	2011	2012	2013	2014	2015
No. Counties	29	37	44	39	41	39
No. Traps	54	67	88	89	96	91
Avg. No. WBC / Location	13	23	42	66	117	266
Range in Totals	0 - 99	0 - 165	0 - 344	0 – 853	0 – 1019	0 – 1688
Peak Flight	2-Aug	2-Aug	25-Jul	21-28-Jul	3 – Aug	2 - Aug

*Data compiled from WBC trap catch information provided by field corn, sweet corn, and dry bean monitoring networks across NY.

Pheromone trap data has documented WBC moth activity, peak flight and has enhanced timing of field monitoring for egg masses and larvae. Timing and intensity of WBC moth flights have varied slightly annually with peak flights occurring between the last week of July and the first week of August (Figure 6). This consistent timing of moth flight activity is being used to evaluate accuracy of a midwestern US WBC moth degree day emergence prediction model for its application in the northeast.

Monitoring and Management:

WBC moths prefer pre-tassel corn for their egg laying site and egg masses may be found on the upper surface of leaves at or near the tassel whorl. Young WBC larvae may feed on leaf surfaces but quickly move to corn ears where they can be found feeding on silks or kernels. By contrast, in dry beans WBC lay their egg masses on the undersurface of leaves and larvae feed on pods at night and hide in the soil during the day making them very difficult to detect. Midwestern experience suggests crops at risk be monitored closely for WBC activity when accumulated trap catches approach 100 moths or more. Midwestern and Ontario WBC corn monitoring guidelines recommend carefully searching for egg masses on 10 corn plants in a row in 10 areas of the field.

Our NY management guidelines reflect what is recommended in Midwestern states and Ontario. When possible plant corn early, use short season hybrids to get past pre-tassel stages before peak flight (typically end of July). Bt corn hybrids containing the Cry1F (e.g. Herculex 1, Xtra, Optimum AcreMax1, SmartStax), or Vip 3A (Agrisure Viptera) hybrids have efficacy against western bean cutworm. Refer to WBC pheromone trap data, if available, to time WBC monitoring activities. Monitor fields to assess risk and need for control. Prioritize fields for monitoring dependent on plant stage, recalling pre-tassel corn is highly attractive to WBC for egg laying. Follow threshold guidelines: field corn 5% of plants with egg masses; sweet corn – processing 4%, fresh market 1%; and dry beans – 1st signs of pin feeding, watch nearby corn for signs of WBC activity.

Midwestern and Ontario entomologists suggest a foliar insecticide spray is warranted if 5% of non-Bt corn or transgenic corn without protection against WBC have WBC egg masses on them. Ontario recommends timing an insecticide foliar spray application for just after egg hatch when small larvae are present at the top of the plant. Egg hatch occurs a day or two after the egg masses turn purple (typically 5-7 days after being freshly laid). (See more at: http://fieldcropnews.com/2013/07/western-bean-cutworm-thresholds-for-high-risk-fields-in-ontario/#sthash.crBkKtBo.dpuf). A summary of hybrids containing Bt traits effective against WBC can be found at Handy Bt Trait Table (http://msuent.com/assets/pdf/28BtTraitTable2015.pdf).
Late season activities - monitor corn for ear molds and need for early harvest.

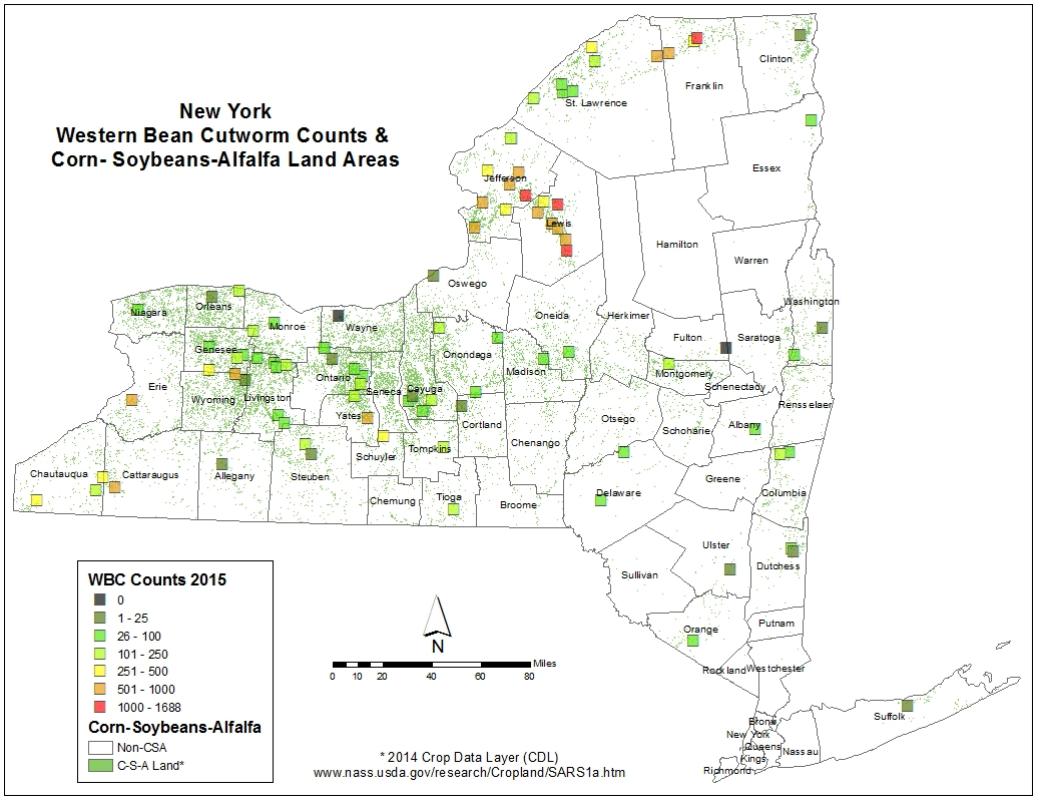
Thresholds are not currently available for WBC in dry beans. Dry bean fields adjacent to corn fields that have reached WBC threshold should be considered at risk and monitored closely for signs of foliar or pod feeding by WBC larvae. If bean pods are present and fresh signs of pod feeding are easily found, Michigan and Ontario entomologists recommend spray application is necessary.

There are a number of factors that can impact the severity of damage from Western Bean Cutworm. These may include the size and survival of over-wintering WBC population; type of Bt gene if a Bt trait hybrid is being used; synchronization between corn silking date and timing of moth flight; use of insecticide sprays for 2 generation European corn borer or other late season ear worms; number of WBC egg masses & survival of young larvae (hot and dry conditions cause mortality); competition/predation/parasitism/diseases including: European corn borer, corn earworm or fall armyworm larvae in the ear or presence of *Trichogramma* egg parasites, nuclear polyhedrosis viruses or entomopathogenic fungi affecting egg or larval stages and environmental factors influencing ear mold development.

Recent observations of note:
Ontario entomologists have reported field corn production areas with above threshold levels of WBC since 2013 and a number of dry bean fields in southwest Ontario had noticeable pod damage in 2015 for the first time. (J. Smith and T. Baute (University Guelph, Ridgetown and OMAFRA). In 2013, heavy populations of WBC in some western Ontario "hotspot" areas were reported causing significant damage SmartStax and Herculex hybrids (Cry1F Bt hybrids). (http://fieldcropnews.com/2014/07/does-spraying-bt-corn-for-western-bean-cutworm-make-sense/). There have been similar reports of high WBC populations challenging Cry1F Bt hybrids in areas of the Midwest. WBC populations were reported causing economic damage in Ontario province in 2014 and 2015. Ontario entomologists suspect more WBC were seen outside its typical range due to later planting dates outside the hot-spot areas that were attractive to female moths looking for pre-tassel corn to lay their eggs. 2014 was the first year Ontario had multiple fields of edible dry beans with easily visible WBC damage (http://fieldcropnews.com/2014/09/scout-for-western-bean-cutworm-and-ear-mould-now/).

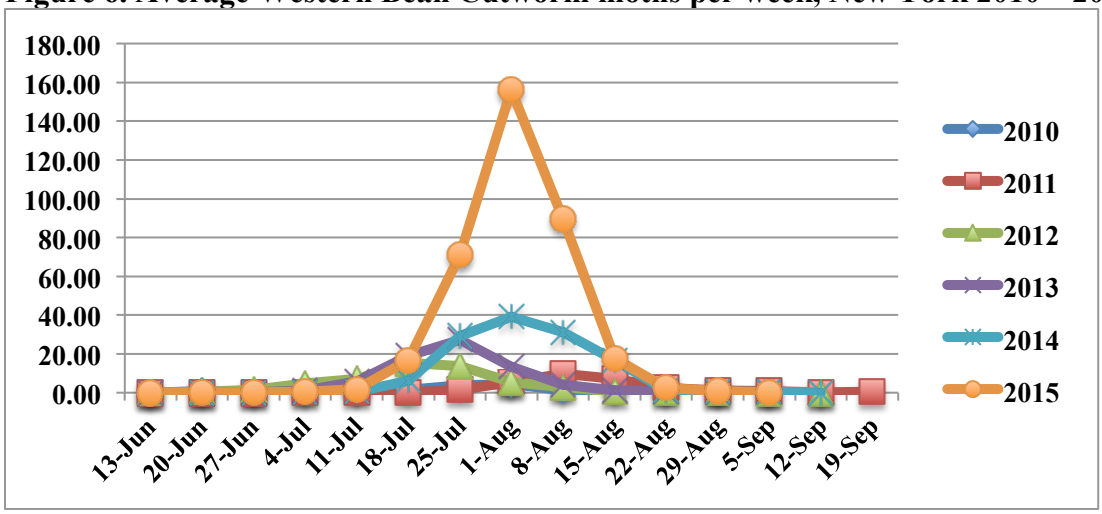
In 2014 and 2015, WBC larvae were found feeding in sweet and field corn in northern and western NY. In 2015, WBC damage was reported to untreated fresh market sweet corn in northern NY (11% losses in Oswego, NY, M. Zuefle pers. com.), WNY field corn (M. Stanyard, WNY CCE Dairy/field crop team, pers. com). This past season was the first year that dry bean pods with WBC feeding damage was seen in the field. Some dry bean producers have begun to apply an insecticide just after the time of peak moth emergence (C. MacNeil, WNY CCE Veg Program).

Figure 5. Western Bean Cutworm trap location and accumulated moth capture for 2015.



Pheromone trapping 2010 – 2015 has documented when WBC moths are active. This information is being related to a growing degree model to help fine-tune crop monitoring activities. The peak WBC flight in 2015 was recorded the week of August 1 (Figure 6).

Figure 6. Average Western Bean Cutworm moths per week, New York 2010 – 2015.



The range of accumulated WBC moths captured per trap in New York by year (2010 – 2015) are shown in figure 7. In 2010, the majority of accumulated trap catches in NY were less than 25 per trap. WBC trap catches have increased every year since. WBC "hotspots" occurred in northern and western NY locations monitored in 2015. Statewide, 7 sites caught less than 10 WBC moths, while 53% of traps caught more than 100 moths per trap. The highest WBC trap count to date, 1688 WBC moths, was collected from a Jefferson County location surpassing last years highest trap of 1019 found in St. Lawrence county trap. Accumulated New York WBC trap catch data by 2015 location are shown in Table 2.

There has been a trend of more WBC moths being captured per location each year as seen in Table 1 and Figure 7. While actual accumulated trap counts ranged from 0 to 1688, the statewide average WBC moth catch per location this year was 266 shown in Figure 8.

Figure 7. New York WBC percent of trap captures within a range (2010 – 2015)

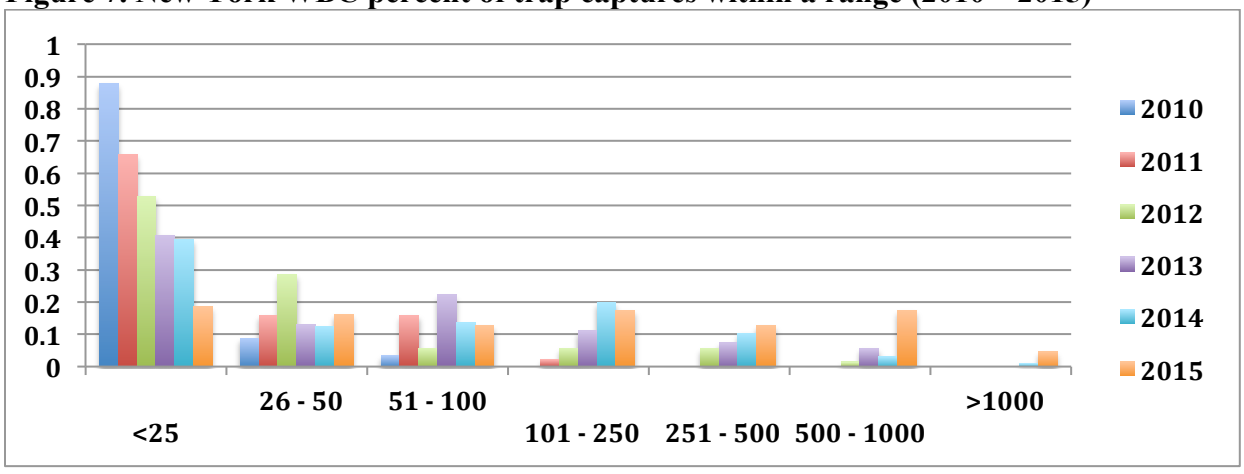


Figure 8. Average Number WBC Moths Per Trap By County Compared to NY State Average in 2015.

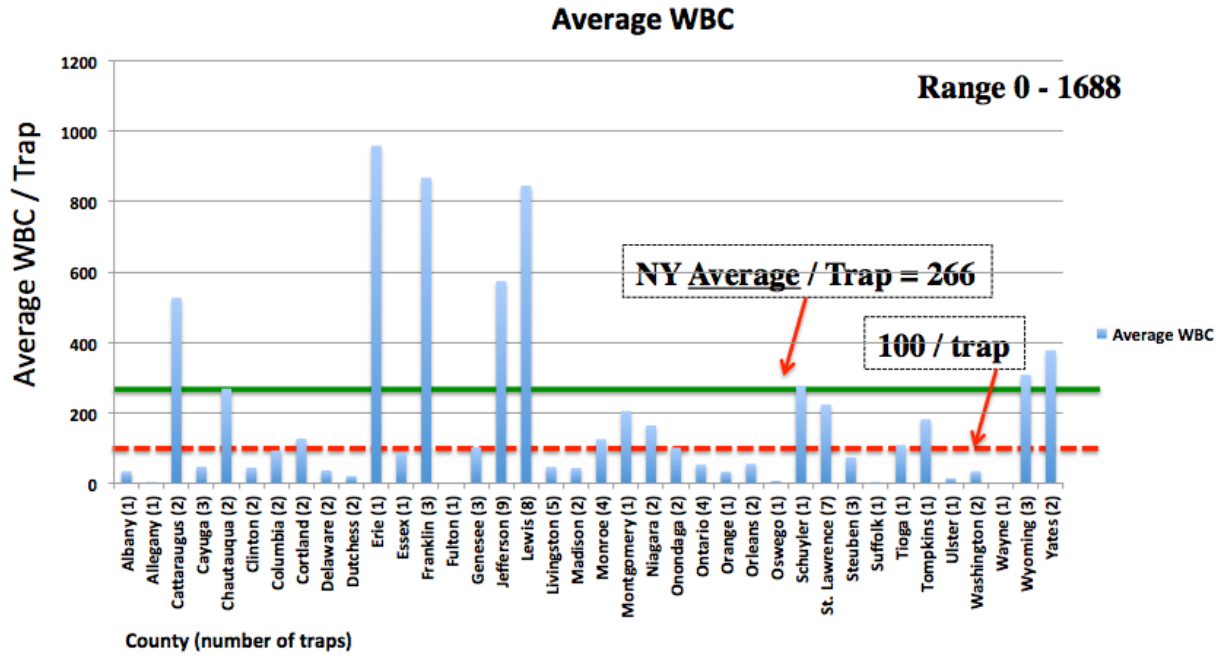


Table 2. 2015 NY Western Bean Trap network accumulated catch totals by location.

County	Town	Total	County	Town	Total	County	Town	Total	County	Town	Total
Albany	Feura Bush	34	Franklin	Moira	644	Livingston	Caledonia	78	St. Lawrence	Heuvelton	59
Allegany	Belfast	4	Fulton	Broadalbin	0	Livingston	Groveland	75	St. Lawrence	Lawrence	851
Cattaraugus	Randolph	398	Genesee	Batavia	60	Madison	Kirkville	53	St. Lawrence	Lisbon	107
Cattaraugus	Randolph	527	Genesee	LeRoy	92	Madison	Munnsville	34	St. Lawrence	Madrid	182
Cayuga	Aurora	93	Genesee	Stafford	156	Monroe	Hamlin	109	St. Lawrence	Rennselaer Falls	38
Cayuga	King Ferry	30	Jefferson	Calcium	585	Monroe	Spencerport	34	St. Lawrence	Waddington	255
Cayuga	Sherwood	19	Jefferson	Chaumont	286	Monroe	Spencerport	197	Steuben	Avoca	24
Chautauqua	Hamlet	413	Jefferson	Ellisburg	812	Monroe	Pittsford	161	Steuben	Avoca	157
Chautauqua	Kennedy	125	Jefferson	Evans Mills	642	Montgomery	Palatine Bridge	205	Steuben	Wayland	39
Clinton	Chazy	21	Jefferson	Hounsfield	542	Niagara	Barker	297	Suffolk	Riverhead	2
Clinton	Beekmntwn	68	Jefferson	Plessis	236	Niagara	Lockport	32	Tioga	Owego	108
Clinton	Peru	167	Jefferson	Plessis	102	Oneida	Clinton	72	Tompkins	Varna	182
Columbia	Valatie	34	Jefferson	Rodman	277	Onondaga	Baldwinsville	139	Ulster	New Paltz	14
Columbia	Valatie	151	Jefferson	Rutland	1688	Onondaga	Tully	63	Ulster		14
Cortland	Preble	236	Lewis	Croghan	1147	Ontario	Farmington	20	Washington	Easton	56
Cortland	Scott	18	Lewis	Denmark	321	Ontario	Geneva	30	Washington	Salem	12
Delaware	Davenport	36	Lewis	Harrisburg	859	Ontario	Geneva	125	Wayne	Williamson	0
Delaware	Walton	37	Lewis	Lowville	851	Ontario	Seneca Castle	39	Wyoming	Attica	415
Dutchess	Amenia	27	Lewis	Lowville	752	Orange		33	Wyoming	Pavilion	7
Dutchess	Millbrook	14	Lewis	Martinsburg	920	Orleans	Kendall	100	Wyoming	Wyoming	502
Erie	Eden	959	Lewis	Turin	663	Orleans	Waterport	10	Yates	Bellona	234
Essex	Willsboro	86	Lewis	Turin	1243	Oswego	Oswego	7	Yates	Penn Yan	521
Franklin	Bangor	497	Livingston	Avon	33	Schuyler	Valois	277			
Franklin	Malone	1463	Livingston	Avon	28	St. Lawrence	DePeyster	72			

2016?

Weekly WBC pheromone trap survey is expected to continue in the summer of 2016. WBC trap catches are expected to increase, but if so *by how much* and *under what conditions*? Field

monitoring for WBC in 2016 is highly recommended - *especially* in areas that had high trap counts in 2015 and fields with sandy soil types that would allow easier burrowing and may affect overwintering survival. WBC trap count updates will be provided during the field season at NYS IPM Weekly Pest Report: http://blogs.cornell.edu/ipmwpr/#, the NY Sweet Corn Pheromone Trap Network: http://sweetcorn.nysipm.cornell.edu/, and the Penn State "Pest Watch" – regional map of WBC trap catches over time: *www.pestwatch.psu.edu/.*

Summary:
Western Bean cutworm populations are widespread across New York and have continued to increase annually. On average, relatively higher WBC counts have been observed in northern and western NY counties. The relatively undamaged wing condition of most moths captured indicates WBC populations are becoming locally established, while others continue to be migrants from other sources. To date there have been no reports from New York of economic damage caused by WBC to corn (sweet or field) or dry beans although a few growers have reported WBC larval presence and some damage. WBC pheromone trap monitoring efforts are planned for summer 2016.

Acknowledgements:
2015 New York WBC Pheromone Trap Monitoring Network*: Thanks to cooperating growers for allowing us to use their fields for sample sites. Special thanks to the following individuals for their enthusiasm, dedication, excellent data collection and maintenance of the 2015 WBC trap network: Adam Abers, ACS, Pete Barney, Kevin Besler, Chuck Bornt, Elizabeth Buck, Bill Brennan, Brian Boerman, Jon Bulkeley, Paul Cerosaletti, Dick Davin, Mike Davis, Janice Degni, Dale Dewing, Jim Eve, Harry Fefee, Jennifer Fimbel, Aaron Gabriel, Kevin Ganoe, Jeffrey Gardner, Don Gasiewicz, John Gibbons, Hank Grimsland, Robert Hadad, Christy Hoepting, Mike Hunter, Amy Ivy, Peter Jentsch, George Krull, Jeff Kubecka, Joe Lawrence, Laura McDermott, Carol McNeil, Stephanie Melancher, Sandy Menasha, Jeff Miller, Anne Mills, Callie Musto, Eric Nixon, Kitty O'Neil, Lindsey Pashow, Teresa Rusinek, Abby Seaman, Lauren Sharp, Keith Slocum, Paul Stackowski, Mike Stanyard, Dan Steward, Crystal Stewart, Allie Strub, Don Sweet, Darcy Telinko, Marie Ulrich, Linda Underwood, Keith Waldron, Jen Wilcox, Ken Wise, Glen Yousey, Marion Zuefle, WNYCMA.

*The NYS "Pheromone Trap Network", including western bean trap network cooperators were awarded the NYS Integrated Pest Management Program "2015 Excellence in IPM Award".

Sweet Corn Pheromone Trap Network WBC data provided by Marion Zuefle and Abby Seaman, Cornell University, NYS Integrated Pest Management Program, NYSAES, Geneva, NY.
Dry Bean WBC field data provided by Carol MacNeil and John Gibbons, Cornell Cooperative Extension, Western NY Vegetable Team, CCE of Ontario County, Canandaigua, NY.

Portions of Eastern NY WBC data supplied by Peter Jentsch, Cornell University, Highland Research Lab, Highland NY.

Western Bean Cutworm Monitoring efforts were supported through grants from: USDA-NIFA eIPM and Crop Production and Pest Management, Northeastern Center for IPM, NYS Dry Bean Improvement Association and NYS Dept. of Ag and Markets.

For more information on WBC catches and distribution, please visit:
NYS IPM:

- Weekly Field Crop Pest Report: http://blogs.cornell.edu/ipmwpr/#
- Sweet Corn Pheromone Trap Network: http://sweetcorn.nysipm.cornell.edu/

Eastern NY Sweet Corn Monitoring Program: http://blogs.cornell.edu/jentsch/sweet-corn/

Pestwatch*:* Sweetcorn *IPM Visualization Tool*: www.pestwatch.psu.edu/sweetcorn/tool/tool.html

Penn State Field Crop News: http://extension.psu.edu/plants/crops/news

If you have questions, contact:
J. Keith Waldron
315 – 787 – 2432 jkw5@cornell.edu